

## **Achieving high temporal resolution, parts-per-trillion per minute, mercury field-measurements in aqueous, environmental and industrial systems**

**Philip I. Kilner and Carl E. Hensman**

Frontier Geosciences, 414 Pontius North, Seattle, WA 98109

### **Biographical Sketches of Authors**

Philip Kilner is an environmental chemist for Frontier Geosciences. As a research associate, Mr. Kilner has been involved in a variety of research projects. These have ranged from analytical method development; including work on a number of methods for low level cyanide speciation in water and soils, to research into innovative waste treatment methods; including the investigation of trace metal removal in wastewater and industrial stack emissions. Mr. Kilner is currently devoting much of his time to work on an automated on-line analyzer for total mercury.

Dr. Hensman's research focus' on understanding, developing, and implementing waste emission treatment systems for cleanup of toxic trace metals—specifically Hg—in mining, industrial, and municipal facilities. Sponsors of these projects include national and international industrial clients and government agencies. The US EPA has repeatedly recognized Dr. Hensman's innovations in this area through the award of multiple research grants. He also maintains an active interest in on-line process analysis and product development.

### **Abstract**

Most natural water systems, industrial process and wastewater streams are monitored using analysis of periodic grab samples or 'spot' monitoring. Spot monitoring results in a low-resolution understanding of the aqueous stream's chemistry. With a limited number of data points, transient events may positively bias an analyte's temporally averaged concentration; even worse brief high or low concentration events may not be detected.

To better understand and monitor temporal variability of mercury in natural and industrial wastewater streams with complex matrices, Frontier Geosciences has developed an innovative, robust, continuous mercury monitoring prototype system for onsite use. The system is relatively low in cost and customized to the client's needs. The on-line system is based on well-established mercury measurement methods and laboratory instrumentation, modified to accomplish the difficult demands of online analysis.

The system utilizes online chemical, thermal, and ultra-violet digestion, followed by sample cooling and gas liquid separation to prepare the sample for analysis. On-line sample preparation is tested in the laboratory on the matrix of interest prior to setting the system up in the field. Optimization in this manner allows us to insure that the custom tailored on-line system is able to perform the analysis of simple or complex matrices specific to the client in the most effective and cost efficient manor possible.

Detection is achieved by cold vapour atomic florescence spectrophotometry (CVAFS). A working range of 5 orders of magnitude can be realized with sub ppt detection limits. The analyzer can be run for compliance measurements using ether US-EPA method 1631 or 245.7.

For this presentation the analyzer has been optimised for the analysis of an urban stream, municipal wastewater treatment plant effluent and produced water from an offshore natural gas possessing platform. The details of the method and results of a number of field studies will be presented.